Chapter 1
GENERAL ENGINEERING

General engineering encompasses those engineer tasks which increase the mobility, survivability, and sustainability of tactical and logistical units to the rear of the forward line of troops (FLOT). Such tasks include construction and repair of lines of communication (LOC), main supply routes (MSR), airfields, and logistica] facilities. While these tasks may be performed as far forward as the brigade rear area of the combat zone, most general engineer tasks are performed behind the division rear boundaries. Repair tasks dominate in well-developed theaters. Construction tasks prevail in less-developed theaters.

General engineer missions are usually performed by Engineer Combat Heavy Battalions, Port Construction Companies, Construction Support Companies, Combat Support Equipment Companies, Dump Truck Companies, and Pipeline Construction Support Companies. Divisional and corps combat battalions may also be required to perform limited general engineer tasks. General engineer tasks in a mid-to high-intensity conflict focus primarily on direct support of military forces. In such circumstances, little consideration can be given to nation-building missions. In a low-intensity conflict, nation-building tasks may dominate.

THE GENERAL ENGINEERING PLANNING PROCESS

General engineer requirements in a Theater of Operations are based on an analysis of the terrain, the availability of support infrastructure, the logistical and combat force structure to be supported, and the extent of damage to existing facilities: The senior staff engineer makes the detailed analysis and establishes a prioritized list of requirements. Prioritization is coordinated with the senior operations and logistics staff officers (G3 and G4 at division and corps and Deputy Chief of Staff, Operations and Deputy Chief of Staff, Logistics at Echelons Above Corps).

A detailed terrain analysis is conducted to determine the availability of suitable local construction materials and to estimate the engineer effort required to accomplish the general engineer missions. Preliminary Class IV construction material requirements must be forecast for the logisticians as early as possible in the planning process. This ensures that material is available when it is needed.

The availability of host nation assets must be determined. Those missions that can be performed by host nation units should be processed through the staff officer responsible for host nation coordination.

General engineer missions may be allocated to available engineer units on an area basis or a task basis. That is, engineer units maybe given an area of responsibility or may be tasked with a specific mission, such as repair or upgrade of a specific LOC. Tasks are performed in accordance with the priority list that has been developed in conjunction with the supported commands. Priorities may shift as damage occurs due to enemy combat action. Logistical constraints may also govern the sequence in which general engineer tasks are performed.

General engineer missions may be performed in support of joint or combined operations. Liaison must be established with supported allied forces or other US services to make sure their requirements are included in the planning process. Construction missions in the rear combat zone and communications zone (COMMZ) will be coordinated by the designated regional wartime construction manager.

PLANNING CONSIDERATIONS

HOST NATION SUPPORT

Where possible, host nation capabilities should be identified in peacetime. Civil affairs personnel play a key role in host nation interface. They also assist in establishing procedures for obtaining host nation support. In many parts of the world, host nation capabilities may be limited to providing construction materials. It is important to tap host nation regional expertise early in the planning process, so that engineers can learn local expedient construction methods.

CONTRACT LABOR

Contract labor may be available for use in the COMMZ. If so, contracting officers must be appointed, and a contract management structure established. Use of contract labor frees engineer troop units to move forward and reduces engineer force structure requirements in the theater.

CONSTRUCTION CRITERIA

Wartime construction requirements will be governed by the following criteria:

- Make maximum use of existing facilities (US or host nation controlled).
- Modify existing facilities rather than undertake new construction.
- Use austere design and construction techniques.
- Minimize US engineer troop construction effort.
- Reduce protective construction. Employ passive protection through dispersion of facilities and equipment (to include incorporation of nuclear, biological, and chemical (NBC) protective measures and equipment) to reduce the need for protective construction.
- Use self-help construction. All non-engineer units must use self-help construction procedures to the limit of their capabilities, short of interfering with primary missions, but without wasting scarce construction materials.

LOGISTICS

An extensive logistical and transportation system is required to support the acquisition and distribution of engineer materials. In developed theaters, engineers depend heavily upon locally procured construction materials and existing distribution networks for supplies. In undeveloped or heavily damaged areas, construction materials and distribution networks are not available. Indeed, the engineer effort may be more focused on procuring the necessary material and moving it to project sites than on the project itself. Therefore, the logistics effort must be considered in the planning stage so that projects can be successfully accomplished.

PRINCIPLES OF THEATER OF OPERATIONS CONSTRUCTION

Joint Chiefs of Staff (JCS) Publication 3 defines two construction standards for planning, designing, and constructing facilities in support of contingency operations.

INITIAL STANDARD

The initial standard is characterized by austere facilities. These minimize engineer construction effort and provide facilities which offer immediate operation support to units upon arrival in-theater. Initial standard facilities are intended to be used for a limited time, ranging from one to six months.

TEMPORARY STANDARD

The temporary standard is characterized by minimal facilities, intended to increase the efficiency of operations. Design life of temporary structures is targeted at 24 months.

CONSTRUCTION PRINCIPLES

The principles of construction in the Theater of Operations are speed, economy, flexibility, decentralization of authority, and establishment of priorities.

Speed

Speed is fundamental to all activities in a Theater of Operations. Practices that support speedy construction include:

Use existing facilities. Engineer units must rapidly provide facilities that enable US forces to deliver maximum combat power forward. The use of existing facilities contributes greatly to the essential element of speed by eliminating unnecessary construction effort.

Standardize. Standardized materials and plans save time and construction effort. They permit production-line methods, including prefabrication of structural members. Standardized assembly and erection procedures increase the efficiency of work crews by reducing the number of methods and techniques they must learn.

Simplify. Simplicity of design and construction is vital in wartime because manpower, materials, and time are in short supply. Simple methods and materials allow scarce labor to complete installations in a minimum of time.

Use bare-bones construction. Military engineering in the Theater of Operations is characterized by concern for only the minimum necessities and by the temporary nature of constructed facilities. Adequate, but minimal, provisions are made for safety. For example, local green timbers are often used to construct wharves or pile-bent bridges even though marine borers will rapidly destroy the timbers. The rationale in this case is that the focus of military effort shifts rapidly, justifying a short useful life for the structure. Sanitary facilities may consist of nothing more than pit latrines, because it is not appropriate to provide more permanent or luxurious facilities. In short, quality is sacrificed for speed and economy.

Construct in phases. Phased construction provides for the rapid completion of critical parts of buildings or installations and the use of these parts for their intended purpose before the entire project is completed. Although phased construction is somewhat inefficient, it allows maximum use of facilities at the earliest possible time.

Economy

Economy in Theater of Operations construction demands efficient use of personnel, equipment, and materials.

Conserve manpower. The soldier is the vital element. For this reason manpower priorities go to units in contact with the enemy. Despite the mechanization of modern warfare, battles are still won and territory occupied by ground forces. Construction tasks are time consuming, and engineers and construction workers are often in short supply. Conservation of labor is therefore important. Every engineer must function at the peak of efficiency for long hours to accomplish the engineer mission. Careful planning and coordination of personnel assignments are necessary. Projects must be well organized and supervised. Engineer personnel must be carefully allocated and well provided for. The source of support to engineers will depend upon the nature of established command and control relationships.

Conserve equipment. In the Theater of Operations, military heavy construction equipment will be in short supply. Some civilian equipment may be available. Because of low densities, operational capability of available equipment may be further jeopardized due to shortages of repair parts. Wise use of construction equipment is essential.

Conserve materials. An overseas wartime construction program must be organized to execute the required work in the time allotted and with a minimum of shipped-in tonnage. Local resources must be used and natural resources exploited to the maximum extent possible.

Flexibility

The ever-changing situation in military construction requires that construction in all stages be adaptable to new conditions. To meet this requirement, use standard plans which allow for adjustment and expansion. Standard plans are a part of the Army Facilities Components System (AFCS) and the Navy Advanced Base Functional Component System. The use of alternate materials is permitted, and design is such that a given construction item may have the maximum number of uses. Theater of Operations standard components are flexible. For example, a standard building plan may be easily adapted to be used as an office, barracks, hospital ward, or mess hall. Forward airfields are usually designed and located so that they can be expanded into more elaborate installations as time and resources permit.

The AFCS provides the construction units with standard plans, bills of material (BOM), specifications for construction standards, labor and equipment estimates, and material shipping estimates. This information significantly improves the planning effort at all levels of the chain of command, and provides a common base of information for all units. The AFCS is developed in four technical manuals (TM): TM 5-301, TM 5-302 (a five-volume set of drawings), TM 5-303, and TM 5-304.

Decentralization of authority

The wide dispersion of forces in a Theater of Operations requires that engineer authority be decentralized as much as possible. The engineers in charge of operations at particular localities must have authority consistent with their responsibilities.

Establishment of priorities

It is essential to establish priorities to determine how much engineer effort must be devoted to a single task. While detailed priority systems are normally the concern of lower echelon commands, all levels of command beginning with the theater commander must frequently issue directives establishing broad priority systems to serve as a guide for detailed systems. Resources must initially be assigned only to the highest priority tasks. Low priority tasks must be left undone at first. Some unavoidable risks will result. Tasks must be analyzed and the risk of bypassing them evaluated in order to assign priorities.

By category of work for war-essential missions, theater engineer efforts will generally give first priority to damage repair of air bases and other critical facilities, second priority to LOC repair, and third priority to restoration or renovation of other necessary facilities. Engineer capability will be applied to the prioritized list of war-essential support missions in accordance with the four priority groups shown in Table 1 (see page 6).

Table 2 (page 6) shows a priority scale applied to each category of general engineer work expected to confront Army engineers in the corps rear and COMMZ. Note that priorities change rapidly and are dependent on the tactical situation.

Table 1. Engineer Support Priorities in the Theater of Operations

Group	Priority	Implications of Nonsupport
A	Vital	High strategic importance. Early defeat of friendly forces.
B	Critical	Serious degradation of combat effectiveness. Increased vulnerability on the battlefield. Increased probability of tactical defeats.
C	Essential	Long-term degradation in sustainability. Significant equipment and materiel losses.
D	Necessary	Reduced quality of combat service support (CSS). Short term degradation in sustainability. Moderate equipment or materiel losses. Temporary inconvenience. Minor impact on tactical operations.

Table 2. Sample Integrated Priority List for General Engineering Tasks

Priority	Priority Ranking	Task Description
Vital	1	Assistance in emergency runway repairs.
	2	Essential field site preparations for air defense artillery (ADA) units.
	3	Recovery of prepositioned materiel configured to unit sets (POMCUS) equipment.
Critical	4	Restoration of aircraft operating surfaces (AOS) beyond emergency repairs (at main operating bases only).
	5	Essential support to hospitals.
	6	Assistance in emergency repairs (less AOS) at USAF bases.
	7	Minimum emergency repairs to facilities at Army bases.
Essential	8	Assistance in repair of LOC/MSR damage.
	9	Minimum recovery work at depots.
	10	Construction of POL distribution systems.
	11	Construction of minimum essential logistic facilities.
	12	Minimum restoration beyond emergency repairs.
	13	Force beddown construction.
Necessary	14	Minimum restoration beyond emergency repairs.
	15	New construction at AFCS initial standard.